

CLAIMS

What is claimed is:

1 1. An apparatus for spectral dispersion compensation in an optical
2 communication network, comprising:

3 at least one optical medium having a signal distributed over a plurality of
4 wavelengths, a portion of the signal on each wavelength;

5 a demultiplexer adapted to receive the plurality of wavelengths and divide the
6 plurality of wavelengths into individual wavelengths, the individual wavelengths
7 relatively delayed to reduce inter-wavelength spectral dispersion; and

8 a multiplexer adapted to receive each wavelength and combine the wavelengths
9 onto the optical medium.

1 2. The apparatus of claim 1, further comprising a dispersion compensation
2 element associated with each wavelength, the dispersion compensation element
3 configured to reduce inter-wavelength spectral dispersion.

1 3. The apparatus of claim 2, wherein the dispersion compensation element
2 is a Bragg grating.

1 4. The apparatus of claim 3, wherein the Bragg grating is a fiber Bragg
2 grating.

1 5. The apparatus of claim 3, wherein the Bragg grating is a waveguide
2 Bragg grating.

1 6. The apparatus of claim 1, wherein the multiplexer and the demultiplexer
2 are a surface diffraction grating.

1 7. The apparatus of claim 1, wherein the multiplexer and the demultiplexer
2 are an array waveguide (AWG).

1 8. The apparatus of claim 2, wherein the multiplexer and demultiplexer are
2 an array waveguide and the dispersion compensation elements are waveguide Bragg
3 gratings and the array waveguide and the waveguide Bragg gratings are combined on a
4 single optical substrate.

1 9. The apparatus of claim 1, wherein the optical network is an optical
2 code division multiple access (OCDMA) network and each wavelength comprises
3 information that represents a portion of the signal.

1 10. The apparatus of claim 2, wherein the dispersion compensation element
2 is located at an endpoint of the optical communication network.

1 11. The apparatus of claim 2, wherein the dispersion compensation element
2 correlates the portion of the signal on each wavelength with respect to time.

1 12. The apparatus of claim 1, wherein the multiplexer and the demultiplexer
2 are a single element.

1 13. A method for spectral dispersion compensation in an optical network,
2 comprising:

3 supplying a signal distributed over a plurality of wavelengths to a
4 demultiplexer;
5 dividing the plurality of wavelengths into individual wavelengths;
6 simultaneously altering the relative timing among the wavelengths using a
7 dispersion compensation element associated with each wavelength to reduce inter-
8 wavelength spectral dispersion; and
9 combining each wavelength onto an optical medium.

1 14. The method of claim 13, wherein the altering step is performed by a
2 Bragg grating.

1 15. The method of claim 14, further comprising the steps of:
2 forming the demultiplexer as an array waveguide; and
3 forming the dispersion compensation elements as waveguide Bragg gratings.

1 16. The method of claim 15, further comprising the step of forming the
2 demultiplexer and the dispersion compensation elements on a single optical substrate.

1 17. The method of claim 13, wherein the optical network is an optical code
2 division multiple access (OCDMA) network and each wavelength comprises
3 information that represents a portion of the signal.

1 18. The method of claim 13, wherein the step of simultaneously altering the
2 timing of each wavelength is performed at one end of the optical communication
3 network.

1 19. The method of claim 13, wherein the step of simultaneously altering the
2 timing of each wavelength correlates each signal portion with respect to time.

1 20. An apparatus for spectral dispersion compensation in an optical
2 network, comprising:

3 means for supplying a signal distributed over a plurality of wavelengths to a
4 demultiplexer;
5 means for dividing the plurality of wavelengths into individual wavelengths;
6 means for simultaneously altering the relative timing of the wavelengths to
7 reduce inter-wavelength dispersion; and
8 means for combining each wavelength onto an optical medium.

1 21. The apparatus of claim 20, wherein the means for simultaneously
2 altering the timing of each wavelength is performed by a dispersion compensation
3 element associated with each wavelength.

1 22. The apparatus of claim 21, further comprising:
2 means for forming the demultiplexer as an array waveguide; and
3 means for forming the dispersion compensation elements as waveguide Bragg
4 gratings.

1 23. The apparatus of claim 22, further comprising means for forming the
2 demultiplexer and the dispersion compensation elements on a single optical substrate.

1 24. The apparatus of claim 20, wherein the optical network is an optical
2 code division multiple access (OCDMA) network and each wavelength comprises
3 information that represents a portion of the signal.

1 25. The apparatus of claim 20, wherein the means for simultaneously
2 altering the relative timing of each wavelength operates at one end of the optical
3 communication network.

1 26. The apparatus of claim 20, wherein the means for simultaneously
2 altering the relative timing of each wavelength correlates each signal with respect to
3 time.

1 27. A spectral dispersion compensator for an optical signal distributed over
2 a plurality of wavelengths, the dispersion compensator comprising:

3 a demultiplexer for spatially dividing an incoming optical signal according to the
4 wavelengths;

5 plural dispersion compensation elements for adjusting the relative timing of all
6 of the wavelengths concurrently; and

7 a multiplexer for combining the wavelengths as adjusted into an outgoing optical
8 signal.

1 28. The spectral dispersion compensator of claim 27, further comprising an
2 optical coupler for coupling the incoming optical signal from a first optical fiber to the
3 demultiplexer and for coupling the outgoing optical signal from the multiplexer into a
4 second optical fiber.

1 29. The spectral dispersion compensator of claim 28, wherein the optical
2 coupler is an optical circulator.

1 30. The spectral dispersion compensator of claim 27, wherein the optical
2 signal is an optical code division multiple access signal.

1 31. A method for spectral dispersion compensation for an optical signal
2 distributed over a plurality of wavelengths, the method comprising the steps of:

3 spatially dividing an incoming optical signal according to the wavelengths;

4 adjusting the relative timing of all of the wavelengths concurrently; and

5 combining the wavelengths as adjusted into an outgoing optical signal.

1 32. The method of claim 31, further comprising the steps of:
2 coupling the incoming optical signal from a first optical fiber to the
3 demultiplexer; and
4 coupling the outgoing optical signal from the multiplexer into a second optical
5 fiber.

1 33. The method of claim 31, wherein the optical signal is an optical code
2 division multiple access signal.

1 34. The method of claim 31, further comprising correcting for spectral
2 dispersion within each of the wavelengths.

1 35. An optical device comprising:
2 demultiplexer means for spatially separating by wavelength encoded components of
3 an optical-code division multiple access signal;
4 dispersion-correction means for introducing relative delays among the encoded
5 components to yield dispersion-corrected encoded components; and
6 multiplexer means for spatially combining the dispersion-corrected encoded
7 components.

1 36. The optical device of claim 35, wherein the dispersion correction means
2 corrects for dispersion within each of the encoded components.

1 37. The optical device of claim 36, wherein the dispersion-correction means
2 includes Bragg gratings corresponding to respective ones of the encoded components.

1 38. The optical device of claim 37, further comprising a multiplexer serving
2 as both the multiplexer means and the demultiplexer means.

1 39. The optical device of claim 38, further comprising a monolithic
2 structure including the multiplexer and the Bragg gratings.